

AU/ACSC/1999-221/1999-04

AIR COMMAND AND STAFF COLLEGE

AIR UNIVERSITY

NIGHT VISION GOGGLES
COMPUTER BASED TRAINING

by

Michael L. Waggett, Major, Colorado Air National Guard

A Research Report Submitted to the Faculty

In Partial Fulfillment of the Graduation Requirements

Advisor: Major Brenda F. Roth

Maxwell Air Force Base, Alabama

April 1999

REPORT DOCUMENTATION PAGE				Form Approved OMB No. 0704-0188	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.					
1. REPORT DATE (DD-MM-YYYY) 01-04-1999		2. REPORT TYPE Thesis		3. DATES COVERED (FROM - TO) xx-xx-1999 to xx-xx-1999	
4. TITLE AND SUBTITLE Night Vision Goggles Computer Based Training Unclassified				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S) Waggett, Michael L. ;				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME AND ADDRESS Air Command and Staff College Maxwell AFB, AL36112				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME AND ADDRESS ,				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT APUBLIC RELEASE ,					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT The main product of this research project is the Night Vision Goggle (NVG) Computer Based Training (CBT) program. This paper will outline the instructional design methodology used to develop the training, and the programming considerations that were used to actually build it. The Air National Guard Bureau Airspace and Ranges office requested that a CBT be built that will replace existing live training for initial NVG certification for Range Control Officers. The program was developed using Instructional Design techniques to maximize training and provide an evaluation for certification purposes. This paper will discuss the Instructional Design techniques used. A description of the instructional strategy, storyboard development, and interface development will be discussed. Hardware requirements to run the program, along with installation procedures will also be discussed. Finally, limitations and future applications of this product will also be discussed along with limitations of Computer Based Training products.					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:		17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19. NAME OF RESPONSIBLE PERSON	
		Public Release	22	Fenster, Lynn lfenster@dtic.mil	
a. REPORT Unclassified	b. ABSTRACT Unclassified	c. THIS PAGE Unclassified		19b. TELEPHONE NUMBER International Area Code Area Code Telephone Number 703767-9007 DSN 427-9007	
				Standard Form 298 (Rev. 8-98) Prescribed by ANSI Std Z39.18	

Disclaimer

The views expressed in this academic research paper are those of the author and do not reflect the official policy or position of the US government or the Department of Defense. In accordance with Air Force Instruction 51-303, it is not copyrighted, but is the property of the United States government.

Contents

	<i>Page</i>
DISCLAIMER	ii
PREFACE	iv
ABSTRACT	v
INSTRUCTIONAL DESIGN METHODOLOGY	6
Instructional Strategy	6
Storyboard Development	10
Interface Development.....	11
Aesthetically Pleasing.....	11
Be Forgiving of the User.....	12
Give the User Control	12
INSTALLATION.....	14
System Requirements.....	14
Authorware Module Installation	15
LIMITATIONS AND FUTURE APPLICATIONS	16
Limitations	16
Future Applications.....	16
STORYBOARD EXAMPLE.....	18
LIST OF SOFTWARE/GRAPHICS/SOUND/VIDEO USED	19
<i>Software</i>	19
Graphics	19
Sound	20
BIBLIOGRAPHY	21

Preface

When I was presented with the requirement to conduct research at Air Command and Staff College, I wanted to do a project that would help out Air National Guardsmen in the field. My recent experience as a Range Control Officer for Airburst Gunnery Range in the Colorado Air National Guard helped me to identify a learning need in the area of Night Vision Goggle training. The Return on Investment for this project will be reduced travel costs for range personnel to attend training, self-paced learning, and a cost effective certification process that is easily adaptable to changes in the Night Vision Training curriculum.

I would like to acknowledge the invaluable assistance I received from Major Brenda Roth. Major Roth was my faculty research advisor for this project and provided the necessary feedback and initial Alpha testing to ensure that this Computer Based Training was quality. I would like to acknowledge the graphics assistance I received from Interactive Eye, L. L. C. and in particular Mr. Kevin Johannen for granting me copyright permission to use their wonderful graphics and movies. I would also like to thank the Air National Guard Bureau Office of Ranges and Airspace and in particular Mr. Pat Welsh for allowing me the opportunity to take on this important training challenge.

Abstract

The main product of this research project is the Night Vision Goggle (NVG) Computer Based Training (CBT) program. This paper will outline the instructional design methodology used to develop the training, and the programming considerations that were used to actually build it. The Air National Guard Bureau Airspace and Ranges office requested that a CBT be built that will replace existing live training for initial NVG certification for Range Control Officers. The program was developed using Instructional Design techniques to maximize training and provide an evaluation for certification purposes. This paper will discuss the Instructional Design techniques used. A description of the instructional strategy, storyboard development, and interface development will be discussed. Hardware requirements to run the program, along with installation procedures will also be discussed. Finally, limitations and future applications of this product will also be discussed along with limitations of Computer Based Training products.

Chapter 1

Instructional Design Methodology

This chapter will discuss the Instructional Design considerations that were used in building the Night Vision Goggle (NVG) Computer Based Training (CBT) program. Instructional Strategy for the CBT will be discussed, followed by storyboard development, and how these storyboards translated into the interface development.

Instructional Strategy

The goal of the instructional strategy for this CBT was to select an approach that can accommodate the learning requirements imposed by each task identified in the task analysis. The original task analysis was conducted by Armstrong Laboratories, night vision goggles division for the current instructor syllabus. An instructional strategy should prescribe a type of learning experience needed to promote mastery of identified tasks. It should also characterize the learning experiences the student will undergo, identify the type of practice students will engage in, the type of presentation that will be used to prepare them for it, and feedback associated with the training.

Thirteen general principles for the instructional strategy were used to articulate the overall general instructional strategy. These principles are influence/credibility, attention/motivation, objectives, context/familiarity, mental set, chunking, illustrations,

intra-organizers, relevant examples, frequent relevant practice, feedback, review, and memory/reference. The first principle, influence/credibility, is based on the idea that students learn and believe a product only if it has expertise and is attractive to the student. This CBT was based on the most current information available, and is credited to Armstrong Research Laboratories for night vision, a credible and relevant source to Range Control Officers. The CBT also uses attractive relevant graphics along with a neat and educationally sound screen layout. It also is error free in text and graphical representations, and liberally uses appropriate diagrams, pictures, and animations.

Using the principle of attention/motivation, this product attempts to relate the student to the “big picture” of why the student should complete the training. Animation, active participation and interaction by the student are used to try to intrinsically motivate and keep the learners attention throughout the CBT.

The principle of objectives is followed in the product by telling the student at the outset of each module exactly what they will be learning and what they will be able to do after they finish the training. The objectives are also specific, concrete, and based in real world terminology.

The principle of context/familiarity is followed in the CBT by presenting the material in the context of something they already know, and is taught using familiar concepts and terminology. The student will learn new information by linking or relating that information to something they already know or understand. This is done by using links, or hooks to what they already know, using analogies when appropriate, generalizing from examples to principles, and adding details to already known information. Building on blocks of information (facts, ideas, and procedures) that

students already know uses familiarity. New material was presented using building blocks when possible, using recall for the students for what they already know, and explaining how the new information builds on what they already know.

The principle of mental set is used to allow students to focus their minds on the information they will be learning and helps block out extraneous or irrelevant ideas. It provides them with an overall structure (like the border of a jigsaw puzzle) in which to fit the small pieces of information that will be coming. Using this principle, the CBT presents the information in a brief and succinct, yet accurate form. It also explains how the lesson is organized by sequence of content by using a lesson map.

Along with this principle, the principle of chunking is used. Students can only perceive limited amounts of information at one time. Students normally can only remember seven (plus or minus two) meaningful pieces of information at one time. This CBT ensures that each task contains a logical group of no more than seven items, whenever possible.

The principle of illustration helps with chunking. Students learn better from materials that combine text and graphical representations. Graphics and text are combined in this CBT to influence, direct, control, organize and simplify the student's perceptions of instructional messages.

The principle of intra-organizers performs the same function as the "mental set." It helps the learner through the material and prepares them for upcoming topics. This differs from the mental set in two ways. Intra-organizers appear throughout the explanation and summary sections of the lesson instead of just the introduction, and they help remind the learner where the current topic fits in relation to all the other topics in the

lesson. This CBT places intra-organizers where natural breaks occur within the training sequence and uses short phrases to preview the material about to be taught.

The principle of relevant examples is also used in this CBT. Students learn ideas better if they are presented with examples of those ideas. Examples mean typical instances of the ideas or concepts being taught, that illustrate the ideas or concepts with real-world objects, situations, or descriptions. Using examples and non-examples will help the student recognize the boundaries of the idea, including what and what it does not include. Examples also help the student discriminate one idea from another that may seem identical, but is not.

The principle of frequent relevant practice is used in this CBT. If students are to learn, it is not enough to simply explain the concepts well. In addition, the students must have the opportunity to respond to the information presented by practicing the skills being taught. By giving the learners the opportunity to practice, two things are accomplished. The first thing is that learning is increased, and the second is that students will have confidence in their learning. “Relevant” means that practice alone is not enough. The type of practice provided for the learner is crucial to whether the practice helps them learn. The questions asked about the information and the exercise requiring skills practice must match, as closely as possible, the way the skill would be used with Night Vision Goggles. “Frequent” means that the practice must be more than a single test or practice opportunity at the end of the lesson. This CBT tried to design practice exercises that matched the objective, the application, and required thinking and processing of information, rather than memory.

The principle of feedback is used in all evaluation instruments in the CBT. Immediate feedback is provided during the review portion of each lesson, and is then provided after the comprehensive review and the actual assessment for certification. Feedback is important for students to gain confidence in the material, and to correct learning objective misperceptions. Feedback will be immediate, simple and to the point.

In conjunction with the principle of feedback is the principle of review. Students learn best when, after being presented with a large amount of information, they are given a summary of the information that repeats and ties together all the pieces for them. Repeating the information in the same manner is not enough however. To help the students understand and apply what they have learned, the review must explain it in a slightly different way. The review should highlight key points and provide a final example that shows pieces of the information being applied together.

The final principle used in the instructional strategy for this CBT is the principle of memory/reference. It is helpful for the student to have a final synthesizing practice, sometimes referred to as a test. This enables the learner to recall and apply what they have learned. Using the memory/reference principle, this CBT includes practice at the end of each lesson. It is in the form of a synthesizing test that is at the application level, not the memory level, whenever possible. It also applies all of the information in one complete smooth flow, and uses a situation different from that was used previously in the instruction, guided practice, or additional independent practice.

Storyboard Development

When actual development of a CBT is accomplished it is very important to have a tool to help the developer layout each individual screen. Storyboards allow the designer

to communicate to the developer exactly what elements each screen contains, and where the element will be placed on the screen. Storyboards are the bridge from the designer's instructional ideas and the developers actual production of these ideas onto a computer screen. In the case of this CBT, the designer and developer is the same person. Storyboard development is still important however, to ensure that the instructional content is logically laid out with the same look and feel throughout all modules of the CBT. Storyboards were developed for screens of the CBT using an original format developed in Microsoft Access. Elements of the storyboards include areas for text, graphics lists, sound files, movie files and special navigation instructions for the developer. The ultimate goal of storyboard development is to provide all information and special instructions that will allow any developer to build the computer screen exactly as the instructional designer envisioned it. An example of a typical storyboard used in this CBT is attached in Annex A.

Interface Development

Interface development for the Night Vision Goggle CBT utilized some basic principles. A good interface should always be aesthetically pleasing, should be forgiving of the user, and always give the user control of the CBT. Each of these principles will be briefly discussed in the context of how they were used in this project.

Aesthetically Pleasing

When an interface is aesthetically pleasing, it will have clarity, or visual elements that are understandable, relating to the user's real-world concepts and functions. Metaphors and analogies should be realistic. Interface text should be simple,

unambiguous, and free of computer jargon. An interface should also be comprehensible and the user should always know what to look at, what to do, when to do it, and how to do it. The interface should also be consistent throughout the entire CBT. It should look, act, and operate the same throughout the training so that the learner will not have to struggle to find information. In conjunction with consistency, the interface should also be efficient, minimizing eye, hand and other control movements. Familiarity is also used in the interface using the 90% rule. This means that the student will be familiar with 90% of the screen, with only 10% new information being presented on the screen. Finally, the interface uses simplicity. The interface is actually a complex system, but is masked by a simple interface that uses progressive disclosure.

Be Forgiving of the User

The interface should always be forgiving of the user. It should have the capability of responding to the individual differences and needs. Predictability is also an important aspect of the principle of be forgiving of the user. In the interface, screen elements should be consistent throughout. This includes user instructions, navigation controls, and screen graphics. Predictability is a direct result of design consistency. In designing the interface the idea of user recovery was also kept in mind. Users should always have the ability to recover quickly from mistakes they make when navigating through the interface.

Give the User Control

User control of the interface should be carefully considered when building CBT. Understanding your user's needs and subsequently adopting their point of view is the starting point. Knowing the user is the fundamental principle in interface design. The

developer of this CBT has experience as a Range Officer, and the point of view of the Range Officer was kept in mind throughout interface development. This interface was also developed with the idea of responsiveness. It should immediately respond to the user's requests and should never leave a screen blank for more than a moment. Finally, the interface was built using the idea of transparency. Transparency permits the user to focus on the task or job without concern for the mechanics of the interface. This interface should never distract the user, but hopefully will help generate interest in the subject.

Chapter 2

Installation

This chapter will cover the system requirements for installing and using the NVG CBT. Complete system requirements and installation procedures are also included on the actual final product CD-ROM.

System Requirements

This product was designed to run on most computer systems that are found at Air National Guard ranges. As a minimum, the CBT will run on a Pentium computer with a processing speed of 100 MHZ. The CBT also should run with a minimum of 16 MEG Random Access Memory (RAM). These system requirements are the minimum needed to run the program, but are not the optimum requirements. The best performance for this product will be seen on a Pentium Computer with a processing speed of 133 MHZ or higher, with 32 MEG RAM or higher. Other hardware needed for the CBT include a 16 Bit or better sound card, and a 16 Bit or better Video card. Every Air National Guard Range has a computer system that can support this optimum configuration. Software requirements include Microsoft Windows 95/98/NT, Microsoft Video for Windows, and Apple Quicktime for Windows. In order to view the web-based training portion of the CBT, Netscape Navigator must also be installed on the system. To use the note-taking feature of the CBT, Microsoft Wordpad must be installed. All required software to run

this CBT with the exception of the Windows operating system, and Microsoft Wordpad is included on the CD-ROM along with a self-extracting installation program.

Authorware Module Installation

To install this CBT on a computer system, all that is required is to open the NVG CBT folder on the CD-ROM and double-click on the setup.exe icon. This will open the setup wizard and allow step by step installation on the computer hard drive. For the full installation option, there must be approximately 70 MEG of available hard drive memory. If this much memory is not available, the program can be run directly from the CD-ROM. A read me text file is also included on the CD-ROM that will detail how to run the program directly from the CD-ROM with no hard drive memory requirements. If this option is chosen, the program will not run at optimum speed because of the large amount of graphics and video that is included in the CBT. All components to run the CBT will automatically be installed if the full install option is selected in the set-up wizard.

Finally, the screen settings for running the CBT must be set-up. The user will need to ensure that the computer screen resolution is set to 800 x 600 and the high color or true color (16 or 24 bit) color setting is selected. Instructions for doing this optimization will be included in the set-up wizard

Chapter 3

Limitations and Future Applications

This chapter will discuss the limitations of this product, and future applications of the CBT. Due to the scope of this project, all modules could not be completed by the Air Command and Staff College research project deadline of 22 March 1999. The timeline for completing the entire CBT will be discussed.

Limitations

There are some limitations associated with Computer Based Training. It is impossible to anticipate all questions that students may have when they are completing the training. In a live training environment, an instructor could answer these questions. Also, if the level of interactivity is not high enough to keep the student engaged, or if the interface design de-motivates the student, it may be impossible to achieve your learning objectives. Finally, if the front-end portion of the instructional design process is flawed, an effective final product may be impossible to build. If the audience analysis, needs assessment, or task analysis are not done correctly, a cascading effect on the quality of the CBT will be seen.

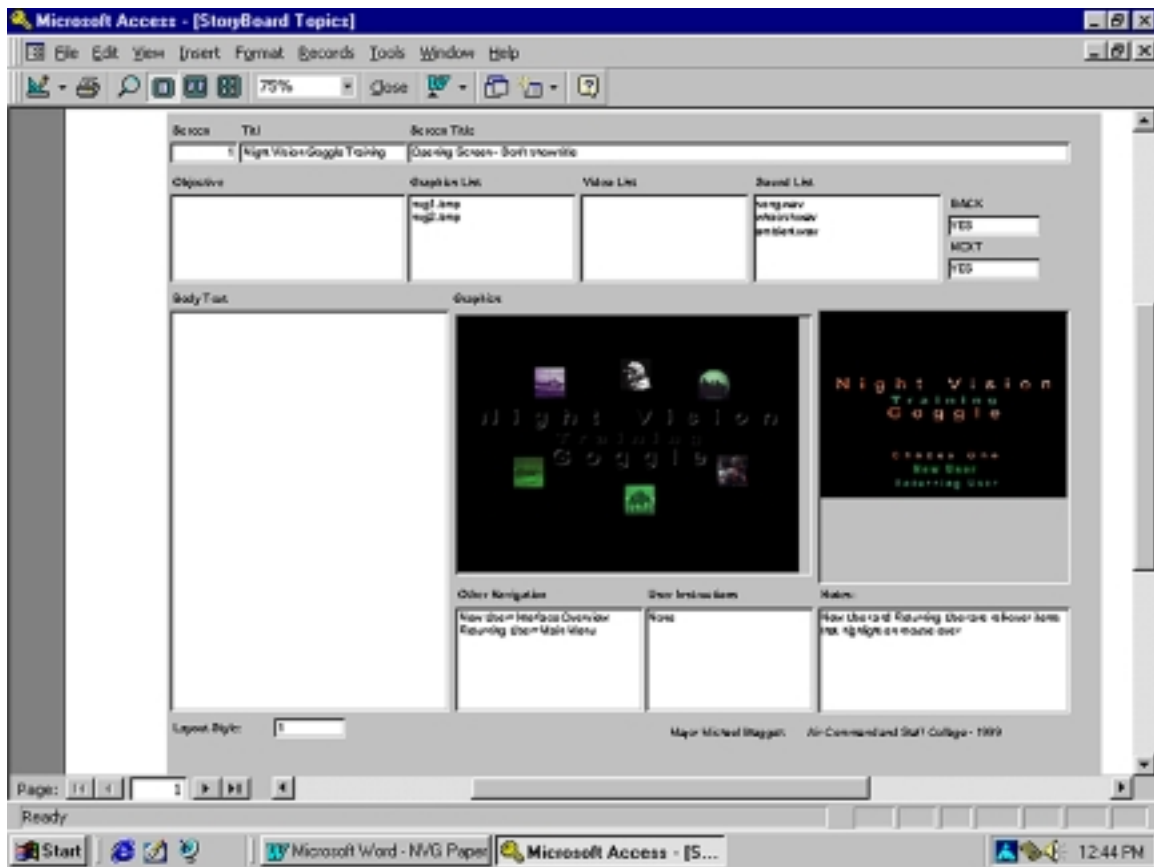
Future Applications

The amount of development time for building the first three modules of this CBT was approximately 300 hours. This product is a alpha version that will be sent to various

Air National Guard ranges for evaluation. If feedback is positive, work on the last three modules will continue with a tentative delivery date in the summer of 1999. This CBT was initially developed in Macromedia Authorware Version 3.5, which is an icon flow-line based CBT authoring program. The CBT was then converted to Authorware Version 4.0, which is licensed to the Air National Guard Bureau. If the CBT meets the needs of the Air National Guard community, it can be offered to Air Combat Command (ACC) Office of Ranges and Airspace for use at ACC ranges. A web-based training product can also be developed as a future application, and may be an appropriate follow on project to the CBT. This CBT includes a prototype of the material presented in HTML format than can be expanded upon in the future. A full list of all software used to develop this product is listed in Annex B.

Appendix A

Storyboard Example



For complete storyboards, please see file storyboard.mdb on CD-ROM

Appendix B

List of Software/Graphics/Sound/Video Used

Software

Adobe Photoshop Version 4.0

Adobe Premiere Version 4.2

Apple Quicktime for Windows

Indigo Rose Setup Factory Version 4.0

Macromedia Fireworks Version 1.0

Macromedia Authorware 3.5

Macromedia Authorware 4.0

Microsoft Access (Office 97)

Sausage Software HotDog Professional 5.0 HTML Editor

Graphics

ACC graphics—URL—<http://www.acc.af.mil>

Armstrong Laboratory, Aircrew Training Research Division/ALHRA Instructor

Syllabus

PowerPoint Presentation

IMSI MasterClips Vector Clip Art

Interactive Eye L.L.C., “Human Vision” CD-ROM (Copyright permission given 1 Feb 1999)

Sound

Distributions Madacy Inc. Fun with Sound effects Vol II

Interactive Eye L.L.C., “Human Vision” CD-ROM (Copyright permission given 1 Feb 1999)

Video

Interactive Eye L.L.C., “Human Vision” CD-ROM (Copyright permission given 1 Feb 1999)

All other graphics/sound/video that are not found in these sources are original work.

Bibliography

- The *Chicago Manual of Style*. 14th ed. Chicago: The University of Chicago Press, 1993.
- Air University. *Air University Style Guide for Writers and Editors*, 1996, n.p. On-line. Internet, 4 November 1996. Available from <http://www.au.af.mil/au/rco/style/>.
- College of Aerospace Doctrine, Research, and Education. *AU Press Author Guide*. Maxwell AFB, Ala.: Air University Press, March 1995.
- College of Aerospace Doctrine, Research, and Education, *AU Press Style Guide for Writers & Editors*. Maxwell AFB, Ala.: Air University Press, December 1994.
- Night Vision Goggle Range Training Syllabus. Armstrong Laboratory, Aircrew Training Research Division/ALHRA. Mesa, Arizona, 1997.

DISTRIBUTION A:

Approved for public release; distribution is unlimited.

Air Command and Staff College
Maxwell AFB, Al 36112